

# NASA TECH BRIEF



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Division, NASA, Code UT, Washington, D.C. 20546.

## Improved Electron Beam Welding Technique

### The problem:

To improve a welding technique by establishing and maintaining a delicate balance between beam power input and the melting and vaporization rate of the work when using a low energy electron beam welder.

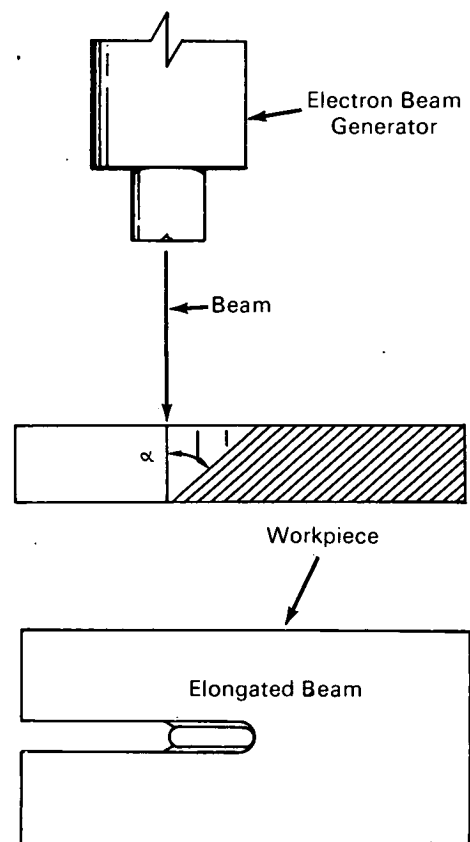
### The solution:

The energy transferred from the source to the work-piece is maximized by relying on the mobility of the material in its liquid phase. This permits more beam energy to transfer to the weld front.

### How it's done:

During the welding, the beam is advanced relative to the work in such a way as to produce an inclined weld or melt front. The hydrodynamic forces arising from the surface tension of the liquid material and the gravity of this down-band welding cause the liquified material to pass behind the welding electron beam and become resolidified. The inclined front is produced by impinging the beam perpendicular to the surface of the work, and the angle of inclination is increased by producing an elongated beam (see fig.) in the region of impingement of the work.

Several hundred welds were made in the described manner, producing an improved weld technique. The electron beam generator was set to project an axially symmetric beam pattern on the workpiece. Beam voltage was set at 150 kV while beam power of different magnitudes (3 to 7 kW) was used for different sets of welds. Beam current was measured with a Faraday cup; scatter losses created by gas in the beam-transfer column did not affect the beam power producing the weld. Most welds of the bead-through-plate type were made on 2219-T87 aluminum.



Formation of an Inclined Weld-Front with an Electron Beam

### Note:

Requests for further information may be directed to:  
Technology Utilization Officer  
Code A&TS-TU  
Marshall Space Flight Center  
Huntsville, Alabama 35812  
Reference: TSP70-10412

(continued overleaf)

**Patent status:**

No patent action is contemplated by NASA.

Source: B. W. Schumaker of  
Westinghouse Electric  
under contract to  
Marshall Space Flight Center  
(MFS-20753)